भारतीय मानक

IS 2246 : 2023

Indian Standard

फ्लुओरसपर (फ्लोराइट) नमूना — पद्धतियाँ

(पहला पुनरीक्षण)

Sampling Fluorspar (Fluorite) — Methods

(First Revision)

ICS 77.080

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August 2023 **Price Group 6**

Ores and Feedstock for Iron and Steel Industry Sectional Committee, MTD 13

FOREWORD

This Indian Standard (First Revision) was adopted by Bureau of Indian Standards, after the draft finalized by Ores and Feedstock for Iron and Steel Industry Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1963. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards. It also incorporates 1 amendment issued to the last version of the standard.

In addition, the following changes have been made:

a) Reference clause is included;
b) Classification of ores is deleted in foreword and placed in **3**; and
c) Fig. 1 and Fig. 2 were reintroduced to bring clarity.

The valuation and grading of fluorspar are based mainly on its chemical composition. Hence it is important that the samples for quality determination should be as representative of the lots sampled as possible. To ensure the representativeness of the samples, it is necessary to uniformly follow scientific methods of sampling as laid down in this standard.

This standard is one of a series of Indian Standards on sampling of ores and aggregates. Other standards in the series are:

IS 1405 : 2010	Iron ores — Sampling and sample preparation — Manual method (*third revision*)
IS 1449 : 2010	Methods of sampling of manganese ores (*second revision*)
IS 1811 : 1984	Methods of sampling foundry sand (*first revision*)
IS 1999 : 1987	Methods of sampling bauxite (*first revision*)
IS 2109 : 1982	Methods of sampling dolomite, limestone and other allied materials (*first revision*)
IS 2245 : 1962	Methods of sampling of quartzite

This standard is intended chiefly to cover the technical provisions relating to the sampling of fluorspar, and it does not include all the necessary provisions of a contract.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAMPLING FLUORSPAR (FLUORITE) — METHODS

(First Revision)

1 SCOPE

1.1 This standard lays down the procedure to be followed in collecting and preparing samples from a lot in order to determine ore sizes, moisture content and the chemical composition of fluorspar in the lot. It details the procedure for sampling the ore from stock piles, rail wagons and ships.

1.2 This standard also includes a method for reporting the quality of the bulk of the fluorspar sampled.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 460	Test sieves — Specification:
(Part 1) : 2020	Wire cloth test sieves (*fourth revision*)
(Part 2) : 2020	Perforated plate test sieves (*fourth revision*)
(Part 3) : 2020	Methods of examination of apertures of test sieves (*fourth revision*)

3 CLASSIFICATION

For the purpose of sampling, fluorspar has been classified into the following three categories on the basis of ore sizes:

a) Run-of-mine ore — of sizes below 100 mm and greater than 50 mm;
b) Sized ore — of sizes less than 50 mm and greater than 15 mm; and
c) Fine ore — of sizes less than 15 mm.

4 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

4.1 Lot/Stock Pile — The quantity of fluorspar indicated (by the supplier) to be of the same category (*see* **3**) offered for inspection at one time; a lot may consist of the whole or a part of the quantity ordered for.

4.2 Sub-lot — The quantity of ore in each of the groups into which a lot/stock pile is divided for the purpose of sampling.

4.3 Increment — The quantity of fluorspar, collected by filling up the sampling scoop to its capacity in a single motion of the scoop.

4.4 Unit Sample — The quantity of fluorspar drawn to be representative of a portion (section) of a sub-lot.

4.5 Gross Sample — The quantity of fluorspar obtained by mixing together all the increments or unit samples collected from the same sub-lot.

4.6 Laboratory Sample — The quantity of fluorspar obtained by reducing a gross sample following a specified procedure and intended for laboratory testing.

4.7 Moisture Sample — A laboratory sample meant exclusively for the determination of moisture content.

5 SAMPLING FROM STOCK PILES

5.1 Sampling of stock piles can be done by any one of the methods described in **5.2** and **5.3**, preferably by the former method; for following the procedures given in **5.3**, the top surface of the stock pile to be sampled should be flat and even over the whole of the stock pile as far as possible.

5.2 Sampling during Loading or Unloading of Stock Pile

5.2.1 *Sub-lots*

The quantity of fluorspar to be loaded into or unloaded from a stock pile shall be considered as divided into the number of sub-lots of approximately equal weight, specified in Table 1.

5.2.1.1 While loading or unloading the quantity of fluorspar constituting a sub-lot, the number of increments specified under ‘point sampling’ in Table 2 (depending upon the quantity of fluorspar in the sub-lot) shall be collected at regular intervals during the whole period of loading or unloading the sub-lots. The increment, each of weight 4 kg, shall be collected from grabs, baskets, bags or packages (filled with fluorspar).

5.2.2 *Gross Samples*

All the increments collected from the same sub-lot shall be mixed together to constitute a gross sample.

5.3 Sampling a Completed Stock Pile

5.3.1 *Sub-lots*

Ore in the stock pile shall be divided into the number of sub-lots of approximately equal weight specified in Table 1 by suitably marking the line of demarcation on the surface of the stock pile. The ore surface in the sub-lot shall be levelled before sampling. The sub-lots shall be sampled either by the method of sectional sampling (*see* **5.3.1.1**) or by the method of point sampling (*see* **5.3.1.2**).

5.3.1.1 *Sectional sampling*

The number of unit samples to be collected from a sub-lot shall depend upon the quantity of fluorspar in the sub-lot in accordance with Table 2. For collecting these unit samples, an equal number of points shall be located at random on the ore surface in the sub-lot.

At every selected point, a unit sample shall be collected by taking the whole section of the ore from top to bottom over an area of a circle of 15 cm diameter. For doing so, ore from the surface down to a depth of approximately 45 cm shall be collected first. The bottom of the hole so formed shall be covered with a plate and the ore lying round this hole shall be removed up to the plate so that when the hole is dug further (to collect the unit sample) the ores from sides cannot fill the hole by falling down. This is repeated till the bottom is reached.

5.3.1.2 *Point sampling*

The number of increments to be collected from a sub-lot shall depend upon the quantity of fluorspar in the sub-lot in accordance with Table 2. For collecting these increments, each of weight 4 kg, an equal number of points shall be located on (a) longitudinal parallel lines 1.5 m a part over the whole surface and (b) transverse parallel line 10 m a part on the exposed sides of the sub-lot. The points to be so located shall be evenly distributed over all the lines.

At each of these points a hole of 40 cm depth shall be made from where increments shall be taken by the scoop. Care should be taken to prevent the ores from spilling over the edges of the scoop. The average granulometric composition of the increment must be as near as possible to the composition of the ore being sampled. When the stock pile is made up of bags or packages filled with fluorspar, at each point as selected above, one bag or one package shall be collected. From each bag or package an increment of weight 4 kg shall be collected.

While sampling run-of-mine category of fluorspar, if a lump of size over 100 mm is encountered at any point, the lump shall be picked up as it is (without breaking into pieces) to be accounted for in the determination of ore size distribution as given under **8.3** and in the reduction of gross sample as given under **9.1**.

5.3.2 *Gross Samples*

All the increments/unit samples collected from the same sub-lot shall be mixed together to constitute a gross sample.

5.4 Thus, a lot will be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be processed further individually in accordance with **8** and **9** and tested in accordance with **10**.

Table 1 Number of Sub-lots which a Lot/Stock Pile is to be Divided

(*Clauses* 5.2.1, 5.3.1, 6.2 *and* 7.1)

Sl No. (1)	Weight of the Lot/Stock Pile (in Metric Tonnes) (2)	No. of Sub-lots (3)
i)	Up to 500	2
ii)	501 to 1 200	3
iii)	1 201 to 2 500	4
iv)	2 501 to 5 000	5
v)	5 001 and above	6

Table 2 Number of Unit Samples/Increments to be Collected from a Sub-lot

(*Clauses* 5.2.1.1, 5.3.1.1, 5.3.1.2, 6.2.1, 6.2.2, 6.2.3 *and* 7.1.1)

Sl No.	Weight of Sub-lot (in Metric Tonnes)	Sectional Sampling No. of Unit Sampling for			Point Sampling Number of Increments for		
		Run-of Mines Ore (of Sizes Below 100 mm)	Sized Ore (of Sizes Less than 50 mm and Greater than 15 mm)	Fine Ore (of Sizes Below 15 mm)	Run of Mine Ore (of Sizes Below 100 mm)	Sized Ore (of Sizes Less than 50 mm and Greater than 15 mm)	Fine Ore (of Sizes Below 15 mm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Up to 100	4	3	2	40	30	20
ii)	101 to 200	6	4	3	56	42	28
iii)	201 to 300	7	5	3	68	52	34
iv)	301 to 400	8	6	4	80	60	40
v)	401 to 500	9	7	4	88	66	44
vi)	501 to 600	10	7	5	96	72	48
vii)	601 to 700	10	8	5	104	78	52
viii)	701 to 800	11	8	6	112	84	56
ix)	801 to 900	12	9	6	120	90	60
x)	901 and above	13	10	6	128	96	64

NOTE — This refers to the number of unit samples to be collected from a sub-lot whose height is one meter. This shall be increased or decreased according to the height of the sub-lot by multiplying the corresponding figures by the ratio $\frac{1}{(\text{Height of the sub-lot metres})}$ and rounding of the value so obtained to the nearest integer.

6 SAMPLING FROM WAGONS

6.1 Representative samples of fluorspar may be collected either during the loading or unloading of the wagons, that is, when the fluorspar is in motion (*see* **6.2.1**), or from the loaded wagons, the former being preferable. While sampling fluorspar from loaded wagons, the ore surface of all the wagons should be levelled first and the samples may then be drawn either by the method of sectional sampling (*see* **6.2.2**) or by the method of point sampling (*see* **6.2.3**).

6.2 Sub-lots

All the wagons in the lot shall be divided into the number of sub-lots, of approximately equal weight, specified in Table 1.

6.2.1 *Sampling during Loading and Unloading*

For sampling fluorspar when it is being loaded into or unloaded from wagons, the number of increments specified under (point sampling) in Table 2 (depending upon the quantity of fluorspar in the sub-lot) shall be collected at regular intervals during the whole period of loading or unloading each sub-lot. The increments, each of weight 4 kg, shall be collected from one or more grabs or baskets, bags or packages (filled with fluorspar).

6.2.2 *Sectional Sampling*

The number of unit samples to be collected from a sub-lot shall depend upon the quantity of fluorspar in the sub-lot in accordance with Table 2. For collecting these unit samples, an equal number of points shall be located on the central longitudinal line of the ore surface of all the wagons in the sub-lot. At each of such points, a unit sample shall be collected as indicated in **5.3.1.1**.

6.2.3 *Point Sampling*

The number of increments to be collected from a sub-lot shall depend upon the quantity of fluorspar in the sub-lot, in accordance with Table 2. For collecting these increments, each of weight 4 kg, an equal number of points shall be located on the ore surface of all the wagons in the sub-lot to be sampled, in a chequer-board fashion. Fig. 1 illustrates the location of sampling points, in a chequer-board fashion, for taking 20 increments from a sub-lot of given size. At each of such points, an increment shall be collected as indicated in **5.3.1.2**.

NOTE — In the case of smaller lots of not more than 5 wagons, the unit sample/increments shall be collected from each of the wagons in the sub-lot according to the methods given in **6.2.2** or **6.2.3**. However, in the case of larger lots of more than 5 wagons, at least 25 percent of the wagons, subject to a minimum of 5 shall be selected at random from the sub-lot and then the required number of unit samples/increments be evenly distributed over the selected wagons.

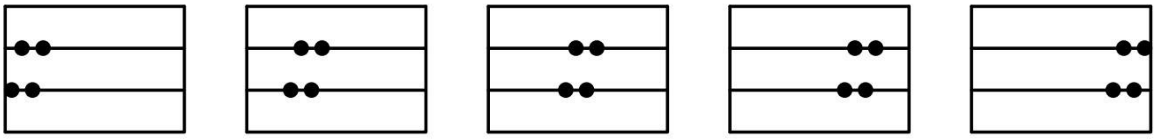

FIG. 1 ILLUSTRATION OF THE LOCATION OF SAMPLING POINTS FOR TAKING 20 INCREMENTS FROM A SUB-LOT OF 100 TONNES OF FINE ORE (LOADED IN 5 WAGONS)

6.3 Gross Sample

All the increments/unit samples collected from the same sub-lot shall be mixed together to constitute a gross sample. Thus, a lot will be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be processed further individually in accordance with **7** and **8** and tested in accordance with **9**.

7 SAMPLING FROM SHIPS

7.1 Sub-lots

The quantity of fluorspar in the ship's holds constituting a lot, shall be divided into a number of sub-lots of approximately equal weights specified in Table 1.

7.1.1 The number of increments to be collected from a sub-lot shall depend upon the quantity of fluorspar in the sub-lot in accordance with Table 2 (under point sampling). The increments shall be collected at regular intervals during the whole period of loading or unloading the material in the sub-lot. The increments, each of weight 4 kg, shall be collected from one or more grabs or baskets, bags or packages (filled with fluorspar) used for loading or unloading.

7.2 Gross Samples

All the increments collected from the same sub-lot shall be mixed together to constitute a gross sample.

7.3 Thus, a lot will be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be processed further individually in accordance with **8** and **9** and tested in accordance with **10**.

8 DETERMINATION OF ORE SIZE

8.1 The size distribution of fluorspar in a lot shall normally be estimated as recommended below:

a) Over 100 mm;

b) Under 100 mm and over 50 mm;

c) Under 50 mm and over 15 mm; and

d) Under 15 mm.

If necessary, ores of other sizes may also be estimated.

NOTE — In the determination of ore size distribution, the test sieves used shall be in accordance with sizes specified in IS 460 (Part 1) and IS 460 (Part 2). As the standard test sieve will become less accurate after period of time, the sieve shall therefore be periodically checked according to IS 460 (Part 3) and the correction factor shall be determined and applied to the result.

8.2 Gross Samples by Sectional Sampling

8.2.1 Each gross sample shall be screened successively through selected sieves (*see* **8.1**) and the quantity of the ore retained on each of the bigger sieves and passing through the smallest sieve, shall be weighed separately and recorded.

8.2.1.1 Ore size distribution for the lot shall be estimated as follows:

$$\text{Over 100 mm, percent } \frac{a_1 + a_2 + \cdots\ldots\ldots}{w_1 + w_2 + \cdots\ldots\ldots} \times 100$$

$$\text{Under 100 mm and over 50 mm, percent } \frac{b_1 + b_2 + \cdots\ldots\ldots}{w_1 + w_2 + \cdots\ldots\ldots} \times 100$$

$$\text{Under 50 mm and over 15 mm, percent } \frac{c_1 + c_2 + \cdots\ldots\ldots}{w_1 + w_2 + \cdots\ldots\ldots} \times 100$$

$$\text{Under 15 mm, percent } \frac{d_1 + d_2 + \cdots\ldots\ldots}{w_1 + w_2 + \cdots\ldots\ldots} \times 100$$

where

a_1, a_2, …………are the corresponding weights of the ore of sizes over 100 mm;

w_1, w_2,……….. are the weights of the different gross samples;

b_1, b_2, ………….are the corresponding weights of the ore of sizes under 100 mm and over 50 mm;

c_1, c_2,………….are the corresponding weights of the ore of sizes under 50 mm and over 15 mm; and

d_1, d_2, …………are the corresponding weights of the ore of sizes under 15 mm.

NOTE — Percentage of ore of any other desired size shall be calculated on similar lines.

8.3 Gross Samples by Point Sampling

8.3.1 Where the gross samples do not contain any lump over 100 mm the procedure detailed in **8.2.1** and **8.2.1.1** shall be followed for estimating the ore size distribution in the lot, the percentage of ore over 100 mm being nil.

8.3.2 Where the gross samples contain some lumps over 100 mm, the portion of the gross samples excluding the lumps shall be treated as in **8.2.1**.

8.3.2.1 The ore size distribution for the lot shall be estimated as follows:

$$\text{Over 100 mm, percent } \frac{4n}{(4n)+w_1+w_2+\cdots} \times 100$$

$$\text{Under 100 mm and over 50 mm, percent } \frac{b_1+b_2+\cdots}{(4n)+w_1+w_2+\cdots} \times 100$$

$$\text{Under 50 mm and over 15 mm, percent } \frac{c_1+c_2+\cdots}{(4n)+w_1+w_2+\cdots} \times 100$$

$$\text{Under 15 mm, percent } \frac{d_1+d_2+\cdots}{(4n)+w_1+w_2+\cdots} \times 100$$

where

n is the total number of lumps over 100 mm in all gross samples;

w_1, w_2……… are the weights of the different gross samples excluding lumps over 100 mm; and

b_1, b_2,……, c_1, c_2,……., d_1, d_2,………etc are as defined in **8.2.1**.

9 REDUCTION OF A GROSS SAMPLE

9.1 Each gross sample shall be reduced separately. Each individual size group of ore above 25 mm in the gross sample shall be crushed to below 25 mm with jaw crusher, roll crusher or by manual labour using pounder and a manganese steel plate. This crushed ore shall be thoroughly mixed and proportionate quantities from each size group including those less than 25 mm of the ore shall be taken to obtain 50 kg of the gross sample. The portion of the gross sample so obtained shall be mixed well and reduced in stages as detailed in Fig. 2 to prepare the moisture sample for the determination of moisture content and laboratory samples for the determination of chemical composition. For reduction at various stages either of the methods detailed in **9.1.1** or **9.1.2** shall be followed. Each moisture sample shall weigh one kilogram and each laboratory sample shall weigh 600 g.

NOTE — The lumps of point sampling (*see* **5.3.1.2**) shall be crushed separately and one increment of 4 kg weight for each lump shall be taken for reduction along with material of other sizes as detailed above.

9.1.1 *Reduction by Coning and Quartering*

The crushed ore shall be well mixed and then scooped into a cone-shaped pile. Care shall be taken to drop each scoopful exactly over the same spot as otherwise the central axis of the cone will be slackened and an uneven distribution of lumps and fines will result. After the cone is formed, it shall be flattened by pressing the top of the cone with the smooth surface of the scoop. Then it is cut into quarters by two lines which intersect at right angles at the centre of the cone. The bulk of the sample is reduced by rejecting any two diagonally opposite quarters.

9.1.2 *Reduction by Using Sample Splitter or Riffle Sampler*

Mechanical quartering is best done with a riffle. After each crushing, the ore shall be well mixed and poured into the riffle. This process shall be repeated using different size riffles according to the size of the crushed ore.

9.2 Laboratory and Moisture Samples

By successive crushing and progressive reduction of the gross sample as illustrated in Fig. 2 an ultimate quantity of 600 g of the material passing through 150 micron IS Sieve shall be obtained as the laboratory sample. The moisture sample of one kilogram shall be collected by progressive reduction when the material is crushed to -10 mm (*see also* Fig. 2). The material in each laboratory and moisture sample shall be thoroughly mixed and divided into three approximately equal parts, one for the purchaser, another for the supplier and the third for the referee. The referee sample consisting of a set of laboratory and moisture samples representing a lot shall bear the seals of the purchaser and supplier and shall be used in case of a dispute between the two.

9.2.1 All the laboratory samples and moisture sample shall be preserved in dry, clean and well-stoppered bottles, labelled with full identification such as the source of the ore, the category of the ore (*see* **3**), the supplier's name, the lot number and the date of samplings. These samples shall be sent to a laboratory, mutually agreed upon by the purchaser and the supplier, for the determination of chemical composition and moisture content.

10 NUMBER OF TESTS

10.1 All the laboratory samples for chemical analysis shall be tested individually for important characteristics; for the remaining, a composite sample prepared by mixing equal quantities of the ore from each of the laboratory samples shall be analyzed. Those chemical characteristics for which each laboratory sample is to be analyzed individually and also those for which a composite sample is to be tested are given in Table 3, unless otherwise agreed between the purchaser and the supplier.

10.2 All the moisture samples representing a lot shall be tested individually for moisture content.

Table 3 Number of Test

(*Clause* 10.1)

Sl No.	**Chemical Constituents of Fluorspar for which**	
(1)	(2)	(3)
i)	Laboratory samples are analyzed individually	A composition samples is analyzed
ii)	Calcium fluoride	Calcium carbonate
iii)	Silica	Mixed oxide, Barium sulphate, lead sulphate, zinc oxide, sulphur

11 REPORTING

11.1 Reporting of Chemical Composition

11.1.1 For those characteristics, where a composite sample has been tested, only one test result will be available and that result shall be reported as the value of the characteristic for the lot sampled.

11.1.2 When only two laboratory samples have been analyzed individually from a lot, the average of the two available test results shall be reported as the value of the characteristic for the lot sampled. The individual test results shall also be reported to give an indication of the range of variation in quality.

11.1.3 When three or more laboratory samples have been analyzed individually from a lot, the quality of the lot sampled with reference to each of the characteristics shall be reported as follows:

Let $x_1, x_2, x_3 \ldots\ldots\ldots\ldots x_n$ be the results of analyzing 'n' laboratory samples for a particular characteristic.

Calculate

$$\text{Average } (x) = \frac{x_1 + x_2 + x_3 \ldots\ldots\ x_n}{n}$$

Range (R) = the difference between the maximum and the minimum values.

The average level of that characteristic in lot shall be reported as equal to x.

The limits of variation in the average level to that characteristic in the lot shall be reported as (x ± hR), where 'h' is a factor, the value of which depends upon the number of laboratory samples analyzed. The appropriate value of the factor 'h' shall be taken from Table 4.

11.2 Reporting of Moisture Content

11.2.1 The results obtained by testing individually all the moisture samples representing a lot shall be reported in accordance with **11.1.2** or **11.1.3**.

Table 4 Values of the Factor 'h'

(*Clause* 11.1.3)

Sl No.	**Number of Laboratory Samples Analyzed**	**Value of the Factor 'h'**
(1)	(2)	(3)
i)	3	1.30
ii)	4	0.72
iii)	5	0.51
iv)	6	0.40

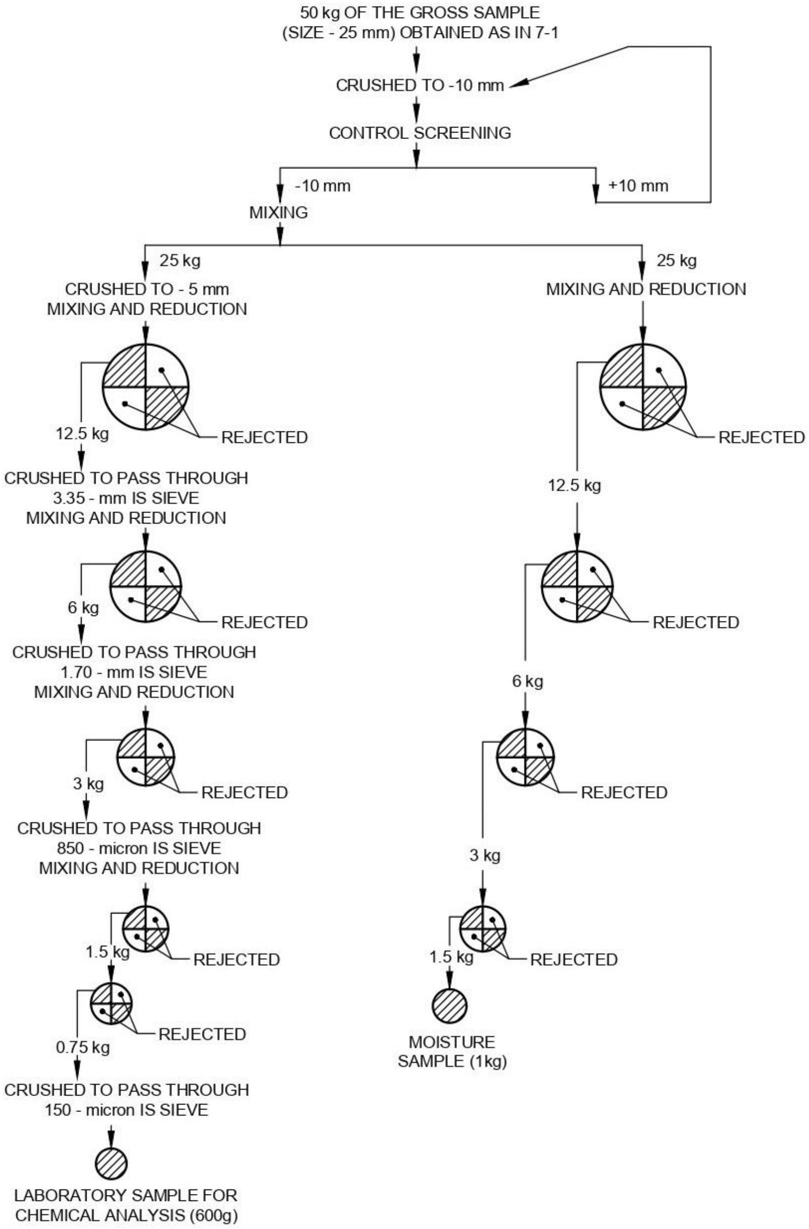

FIG. 2 STAGES IN REDUCING A GROSS SAMPLE

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Ores and Feedstock for Iron and Steel Industry Sectional Committee, MTD 13

Organization	*Representative(s)*
National Mineral Development Corporation Ltd, Hyderabad	Shri Rajan Kumar **(*Chairperson*)**
Agni Steel Private Limited, Erode	Shri A. Rajasekaran
Alex Stewart International (India) Private Limited, Visakhapatnam	Shri Debasish Pal Shri S. Balaji (*Alternate*)
Arcelor Mittal and Nippon Steel India Ltd, Visakhapatnam	Dr Atanu Ranjan Ojha Shri Ch. V. S. Nd. Hariprasad (*Alternate*)
Bhabha Atomic Research Centre, Mumbai	Dr Sanjib Majumdar Dr Abhishek Mukherjee (*Alternate*)
Centre for Engineering and Technology (SAIL/CET), Ranchi	Shri Brajesh Kumar Shri D. K. Jagani (*Alternate*)
CSIR - Institute of Minerals & Materials Technology, Bhubaneswar	Dr Ashok Sahu Dr S. P. Das (*Alternate*)
CSIR - National Metallurgical Laboratory, Jamshedpur	Dr Manoj Kumar Mohanta
Federation of Indian Mining and Mineral Industries, New Delhi	Shri B. K. Bhatia
Fomento Resources Private Limited, Panaji	Shri Mahendra Manguesh Ramani Shri Abhijit Pednekar Ramani (*Alternate*)
Geological Survey of India, Kolkata	Dr Utpal Roy Choudhury
Indian Bureau of Mines, Nagpur	Shri L. B. Toal Shri Santosh pani (*Alternate*)
Indian Ferro Alloy Producers Association, Mumbai	Shri Tanmaya Kumar Pattnaik Shri Sita Ram (*Alternate*)
Jai Balaji Group, Kolkata	Shri D. Sahoo
Jindal Stainless Ltd, Hissar	Shri Ashish Goyal Shri Suyash Trivedi (*Alternate*)
JSW Steel Ltd, Bellary	Shri P. C. Mahapatra Shri C. R. Pramod Kumar (*Alternate* I) Shri N. Sai ram Krishna (*Alternate* II)
KIOCL Limited, Bengaluru	Shri M. A. Salam Shri P. Palani (*Alternate*)

Organization	*Representative(s)*
Manganese Ore (India) Ltd, Nagpur	Shri. Rajesh Bhattacharya Shrimati Sneha Tiwar (*Alternate*)
Mineral Exploration Corpn Ltd, Nagpur	Shri P. Ravindran Shri Santosh Kumar Satapathy (*Alternate*)
Mitra S K Pvt Ltd, Kolkata	Shri Sajal Mitra Shri P. L. Bose (*Alternate*)
M N Dastur & Co Ltd, Kolkata	Shri Avijit Poddar
National Institute of Secondary Steel Technology, Mandi, Gobindgarh	Shri Shri Rajib Kumar Paul Shri Sandeep Pal Singh (*Alternate*)
National Mineral Development Corporation Ltd, Hyderabad	Shri Vibhuti Roshan
Pellet Manufacturer's Association of India, New Delhi	Shri Deepak Bhatnagar
Rashtriya Ispat Nigam Limited, Visakhapatnam	Shri T. Goutham Shri Ranjan Mohanty (*Alternate*)
SAIL - RDCIS, Ranchi	Shri V. Dayal Shri S. Acharya (*Alternate*)
Sponge Iron Manufacturers Association, New Delhi	Shri D. Kashiva
Tata Steel, Jamshedpur	Dr A. K. Mukherjee
Tata Steel Long Products Limited, Jamshedpur	shri Manikanta Naik Shri Gyanaranjan Pothal (*Alternate*)
BIS Directorate General	Shri Sanjiv Maini, Scientist 'F'/Senior Director and Head (Metallurgical Engineering) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri Ram Sai Kumar Gedela
Scientist 'B'/Assistant Director
(Metallurgical Engineering), BIS

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This Indian Standard has been developed from Doc No.: MTD 13 (21913).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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